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OF THE

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OF

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1931.—Transactions, Vol. LXXIX: Part I, £1 1*s.* 0*d.*, to Fellows, 15*s.* 9*d.*; Part II, £1 10*s.* 0*d.*, to Fellows, £1 2*s.* 6*d.*
Proceedings, Vol. VI: Part I, 6*s.* 0*d.*, to Fellows, 4*s.* 6*d.*

ENTOMOLOGICAL SOCIETY OF LONDON

NOTICE

The Council has decided to issue a **new entomological journal,** beginning in January 1932, in 12 parts per annum, entitled

STYLOPS

A Journal of Taxonomic Entomology,
under the editorship of
S. A. Neave, M.A., D.Sc.,
as
Secretary
of
the Entomological Society of London,
assisted by

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A. D. Imms, M.A., Sc.D., F.R.S.
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The annual subscription to "Stylops" will be 24*s*., or $6.00, post free, single parts 3*s*. each, but Fellows of the Society will have the right to subscribe for one copy at the special rate of 16*s*. per volume.

This journal is primarily designed to meet the demand for the prompt publication of short taxonomic papers. For this reason papers exceeding 10,000 words, or occupying more than 12 pages, cannot be accepted for it, and preference will be given to appreciably shorter ones.

The Society is prepared to undertake the provision of a reasonable number of text-figures or plates when only line-blocks are required, though authors will be expected to supply the original drawings. In the case of half-tone or colour work, authors will also be required to pay for, or supply, the necessary blocks.

Authors, who need not be Fellows of the Society, will be entitled to receive 25 copies of their papers free of charge and will be permitted to purchase additional quantities at a fixed scale.

Papers in English, French or German may be submitted, but must be type-written on one side of the paper only.

Those desiring to offer papers should send them to the Editor, at 41 *Queen's Gate, South Kensington, London, S.W.* 7.

THE PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY OF LONDON

VOL. VI. 1931.

Wednesday, February 4th, 1931.

Dr. H. ELTRINGHAM, F.R.S., President, in the Chair.

Obituary.

The death of Mr. EVAN JOHN and of Mr. W. COOK, Fellows of the Society, were announced.

Vice-Presidents.

The PRESIDENT announced that he had nominated Dr. K. JORDAN, Dr. S. A. NEAVE, and Mr. H. WILLOUGHBY ELLIS as Vice-Presidents for the year.

Exhibits.

Mr. G. TALBOT exhibited the unique male of a new *Delias* (Lep. Rhop. PIERIDAE) from Timor, together with a figure of *D. dumasi*, Roths., from Buru, both sexes of *Huphina laeta*, Hew., and the male of *D. splendida*, Roths., from Timor. *D. dumasi* is regarded as being the nearest ally of the new species. The mimetic association of the new species with *Huphina laeta*, of the *dumasi* female with the *Huphina* female, and the male of *D. splendida* with the *Huphina* male, was remarked upon.

A description of the new species, with remarks on its mimetic associations, has been published in *Entomologist*, **64** : 110–111.

Relation of locality to seasonal forms.

Dr. F. A. DIXEY exhibited some butterflies caught by him in South and East Africa in August, 1929, to show the relation of locality to the occurrence of seasonal forms.

The butterflies captured in Bechuanaland on Aug. 4 comprised specimens of *Teracolus achine*, Cram., and *T. evagore*, Klug., all of the dry-season phase. *Belenois severina*, Cram., and *Terias brigitta*, Cram., taken at the Victoria Falls on Aug. 6 and 7, also *Belenois gidica*, Godt., *B. severina* and *Teracolus phlegyas*, Butl., at Kandahar Island on the Zambesi (Aug. 7) were likewise all of the dry-season. At Fort Victoria and the Great Zimbabwe (Aug. 10–12) similar conditions prevailed; the captures included *Precis archesia*, Cram. (the dry-season form of

P. pelasgis, Godt.), *Terias brigitta*, *Teracolus omphale*, Godt., and *T. achine*, again all unmistakably " dry."

But on coming down to the sea-coast at Beira on Aug. 15, a different state of things was found. The wet-season form of *Terias brigitta* taken here was a forerunner of wet-season specimens of *Belenois severina* encountered at Zanzibar and Mombasa, Aug. 20–22.

At Nairobi (Aug. 23–26) the long rains were just over, the short rains being not yet due. Here there was an intermixture of seasonal forms, the " wet " phase predominating in *Teracolus achine* and *Terias brigitta*, while *Belenois mesentina* and *B. severina* were " dry " or intermediate.

Finally, at Njoro (Aug. 23–30), the *Terias brigitta* were " wet," the *Belenois mesentina*, all females, were also " wet," the only *Teracolus achine* taken was intermediate between wet and dry.

Thus within the month of August the forms from the Cape Province to Southern Rhodesia inclusive were dry; from Beira northwards to the latitude of the Victoria Lake, predominantly wet.

Swallows capturing *Polyommatus corydon*, Poda, on the wing, near Painswick.

Prof. Poulton said that he had received the following interesting hitherto unpublished account, kindly written by the observer Mr. F. Bedford, describing the persistent attacks by swallows upon the flying " Chalkhill Blue " :—

" 29 *January*, 1931.—At a meeting of the Birmingham Entomological Society, held a short time ago, the subject of birds taking Lepidoptera was under discusssion, and in the course of this I gave an instance from my own personal observation of swallows taking *P. corydon*.

" Our President, Mr. Colbran Wainwright, thinks that you would be interested if I could detail the circumstances, and I have much pleasure in doing so. I have no written data, but the incident is fixed in my memory because it occurred in the August of 1923, only a few months after I had listened to your lecture, given at the residence of Mr. G. T. Bethune-Baker, on ' Mimicry in Insects,' in the course of which you made reference to the probability of birds being responsible for the destruction of butterflies, and, as we sat on Sheepscombe Common, near Painswick, watching the phenomenon, I gave to my friend Mr. Rush, who was with me, the gist of your remarks, and drew his attention to the proof that birds did take butterflies made evident before our eyes.

" It was a good year for *corydon* at Sheepscombe; the insects were there literally in hundreds, and it was easy to take half a dozen or more with a sweep of the net. We took what we required and sat down to lunch, and it was then that the work the swallows were doing drew our attention. They also were present in goodly numbers, and were wheeling and circling over the Common evidently also intent on lunch—off *corydon*. We watched for about twenty minutes or half an hour, and anyone listening would have heard our remarks—' He got that one '; ' He's missed it '; ' He's got another at the second try,' and so on. How many were taken I should not like to estimate, but one of the remarks we made was that the ravages of the swallows were probably one reason for a fact we had observed during visits in successive years to the Cotswolds—namely that a year of plenty in

corydon and *adonis* (although the latter was not about on this occasion) was often followed by a year or two of comparative scarcity. The pursuit of the swallows was so swift that it was impossible to see whether or not in every instance they took the body and dropped the wings, although sometimes we did actually see wings fluttering down and observed some on the ground afterwards, but I am afraid we were remiss in not making more exact observations as to numbers and in not searching more carefully for discarded wings. It is worth noting, however, that we had taken specimens with wings injured as they would have been if a bird had bitten out a piece without getting a fair hold and the insect had escaped. The weather, I may say, was ideal—a bright warm day of continuous sunshine. You will naturally wonder if there were any other butterflies about and if the swallows were taking them. There were a fair number of Large, Small and Green-veined Whites and also *janira*, a few *megaera*, some *astrarche*, *icarus*, *malvae* and *tages*, with the day-flying moths *glyphica* and *mi*, and I remember distinctly our exclaiming when we saw one *rapae* captured by a swallow, but we did not observe any of the others taken, perhaps because they were present in smaller numbers and also because most of them did not rise so high as *corydon*.

"I hope at some future date to be able to repeat my observations and record more exact details, but, during the last two seasons, in my experience, *corydon*, *adonis*, *minima*, *astrarche* and even *icarus* have been present on the Cotswolds in very much smaller numbers, and I have been there in June and August each year. Last year I saw 5 *corydon* only in the third week in August after visiting Cranham, the Windrush Valley and Crickley, all three prolific haunts in previous years. Furthermore a friend took three decent specimens only in the Windrush Valley above Bourton during the second week in August, and saw a few others in poor condition."

It was interesting to compare these observations of attacks by swallows upon the flying *corydon* with those upon the same species at rest recorded by Mr. C. W. Colthrup, the birds being the Whinchat and Kestrel (1909, *Trans. Ent. Soc. Lond.*, **1909**: 342, 352; 1929, *Proceedings*, **4**: 41).

The Geometrid moth *Dysphania andamana*, Moore, with apparent beak-marks on the R. fore-wing.

Prof. POULTON exhibited a specimen of *D. andamana* taken by his friend Mr. H. G. Champion, at Mt. Harriett, S. Andaman I., 22 Jan. 1930. The tip of the R.F.W. bore two distinct beak-marks, evidently caused by an attack when the wings were expanded either in flight or when settled.

Further observations on the Hummingbird Hawkmoth, *Macroglossa stellatarum*, L., attracted by the representation of flowers.

Prof. POULTON said that Mr. G. Fox-Wilson had kindly directed his attention to the following earlier records of *M. stellatarum* attracted by coloured figures of flowers, as described in 1930 *Proc. Ent. Soc. Lond.*, **5**: 63, 64.

An observation of this kind by Bernard Pérez was recorded by his brother J. Pérez in 1894 *Actes Soc. Linn. Bordeaux*, **47**: 245–253. The Registrar had kindly consulted the paper and written the following account of the parts which

bear upon the subject :—" J. Pérez states that ' this subject was the object of a communication by F. Plateau to the Ass. franç. avance. Sci., 1876,* the author having been led to make some experiments on the subject by an observation of Monsieur R. Vallette on a *Macroglossa stellatarum* which was seen trying to insert its proboscis into some flowers painted on wallpaper.' Pérez continues, ' I can confirm this statement, which has been strongly contested at the Société entomologique de Belgique,† by citing a note from my brother, Bernard Pérez, who, when he made the following concordant observation, was quite ignorant of the fact reported by M. Vallette :—" Un Sphynx du jour (*Macroglossa stellatarum*), est-il dit dans cette note, est entré dans ma chambre, dont la tapisserie fond clair est parsemée de bouquets de fleurs blanches et roses, avec tiges et feuilles vertes. Pendant deux minutes, l'insecte a voltigé de bouquets en bouquets, s'arrêtant devant cinq d'entre eux, la trompe déroulée, comme s'il était agi de réelles. Il a ensuite disparu tout à coup, peut-être parce que j'ai fait quelques mouvements pour l'observer de plus près." ' "

The gregarious sleeping habits of *Heliconius charithonia*, L.

Prof. Poulton said that he had received a very kind letter and a most interesting paper on the above subject, from one of our American Fellows, Prof. F. M. Jones, who had just seen Pt. II of 1930 *Proc. Ent. Soc. Lond.*, **5**, and read the record of Dr. J. G. Myers' observations in Cuba on p. 48. Prof. Jones' paper,‡ " The Sleeping Heliconias of Florida," was of such extreme interest that he felt sure the Society would welcome a full account of the observations and experiments described in it.

The habits of *Heliconius charithonia* were studied by the author in visits, between 8 January and 6 April in different years beginning with 1927, to the Royal Palm State Park, Dade County, Florida. Separate sleeping-assemblages were kept under observation for long periods and proved to persist in some instances for at least four months. Thus a typical populous roost, containing both sexes not very unequal in numbers, was first seen by the author on 18 March 1929, and was still being used when he left on 6 April. Furthermore, he was informed that it had been under observation from early in January and had absorbed another assemblage on a vine about 100 ft. distant. There were then about forty butterflies occupying the two roosts. The combined assemblage rested in " a dead and almost leafless bush standing at the edge of other and living herbage." It was observed daily with night and morning visits during the whole of his stay at the State Park. About twenty to thirty butterflies were usually present in the dead bush each night. " Some of these were bright and fresh, apparently recent emergences; others were tattered and worn and might well have been survivors from the January flock." A longer visit was paid in 1930 and the results of the two series of observations combined in the following account :—

" Of six observed roosting-places, three were at the edge of dense living herbage,

* F. Plateau, L'instinct des Insectes peut-il etre mis en defaut par les fleurs artificielles. Experiences faites a propos d'une observation de M. R. Vallette, 1876. C. R. Ass. franç. avance. Sci. **5** : 535–540.

† On 3 Apr. 1875, when Monsieur R. Vallette communicated his observation.

‡ 1930 " *Nat. Hist.*," *J. Amer. Mus. Nat. Hist.*, **30** : 635.

in dead bushes or broken branches having many fine twigs; two were in pendulous vines, almost leafless but with twigs and interlaced ramifications; one was among the close-set wiry dead stalks and the bare aerial roots of a neglected fern-basket hanging in a slat-house. None was less than two feet or more than eight feet from the ground." They were undisturbed by the proximity of buildings and noisy machinery. The sleeping-groups, each usually containing 20 to 30 butterflies, were fairly compact, with a radius of 12 to 15 inches, and were sometimes accompanied by little outlying groups on adjacent twigs. By day the insects flew in circumscribed areas each belonging to a single group " whose components seem to keep within a few hundred feet of their sleeping-bush."

" In the late afternoon, Heliconias, one by one, commence to drift in to the vicinity of the sleeping-bush. With devious slowness they explore the whole neighbourhood, pausing here and there on some projecting bit of herbage, sometimes basking for a time in the last horizontal beams of sunlight, sometimes alighting on the roost only to leave it again for a further exploring flight. About a populous roost, at sunset, the air is filled with butterflies in swirling flight, which continues in decreasing number of participants as one by one the flock finds a resting-place and hangs motionless in the sleeping posture. Up to almost full darkness, late comers continue to arrive, some apparently flying directly to the roost without preliminary exploring flight and joining the sleeping group; and more than once, after counting the sleepers at the last moment the fading light permitted, we have found that number increased upon visiting the spot at night."

The butterflies remain alert during daylight, but in complete darkness they " may be picked off from the group, even sometimes replaced again, without awakening the rest; but never did we succeed in picking off the whole flock without arousing some remnant of them into flight. When violently awakened, the whole flock literally *explodes* into flight in all directions . . .; " most of them clinging " to the first object into which they bump, and in the morning may be found hanging to adjacent herbage within twenty or thirty feet of the roost."

In order to test the nature of the stimulus which leads the butterflies to seek the same part of their sleeping-bush, experiments of the kind suggested in 1926 *Proc. Ent. Soc. Lond.*, **1** : 48, were undertaken. In the first experiment, made in 1929, the few twigs on which about 30 *charithonia* slept were cut out of the large dead bush and tied at the same height to another bush about ten feet distant. The twigs in the new position were invisible from the old one but were within the area of the preliminary flight. " In the late afternoon we watched the behaviour of the arriving butterflies. The usual performance of the exploring flight about the roost was manifested. In this flight they coursed back and forth through the space formerly occupied by their roosting-twigs, and it seemed obvious to us that there was some recognition of change. In their wider flight, several butterflies paused upon the old twigs in their new position, only to leave them again and rejoin the flying group. Gradually the flock came to rest upon twigs in the old roosting-bush, close to the vacant space left by the removal of the roost itself. After dark, twenty-seven butterflies were found sleeping on these new twigs, and one, alone, on the transferred twigs ten feet away. Next night, this one rejoined its fellows in the old bush."

In the second experiment, made in February, 1930, all the twigs and branches of the roost were cut away and replaced by others brought from a distant brush-heap and tied " into place as nearly as possible in the old site. At dusk, without any obvious hesitation the butterflies accepted this substitution, and that night they slept upon the new twigs in the usual numbers. The roost-location, and not an imparted odor, identified the sleeping-place."

Single butterflies were marked by snipping pieces from their wings (which could be done without disturbing their sleep), and it was thus shown that many of them rested on " the same twig for a short succession of nights. Usually some of the marked butterflies occupied new positions. None maintained the same position for many successive nights, and some of the shifts of position were from one side of the roost to the other, from night to night. That is, there was some evidence that place-memory is definite enough to extend to the location of individual twigs, but abundant evidence that continuous occupancy of them is far from the general rule."

In 1930 three roosts—B, C, and D—within a hundred yards of each other, were observed, and it was found that " there was a constant shift and interchange, from one sleeping-place to another. For example, a marked butterfly . . . was located, sleeping, on twenty-two out of twenty-six consecutive nights; and in this period it made eight changes, back and forth, between roost B and roost C. Its longest observed unbroken stay on one roost was for six successive nights." The fluctuations in the numbers present on any one roost were thus explained.

Again, of two butterflies captured 27 miles away, marked and liberated in the vicinity of the roosts, one disappeared, but the other slept on B the first night, " and for eight of the succeeding eleven nights it was identified among the sleepers on either roost B or roost C, in that period making three shifts between these roosts."

On cool mornings or in heavy rain the butterflies remained torpid till 9.0 a.m. or even later. The breaking up of the sleeping-party was often and carefully observed. In a typical example (23 March) the first butterfly flew slowly away in the dim light at 6.15 a.m., a second at 6.22 flew off, after flapping its wings, followed quickly by a third. At 6.35, " one departing butterfly bumped into the remaining assemblage, which exploded into flight and immediately dispersed. On other mornings, this explosive flight of the entire flock would be the response to our approach, however cautious."

Many concordant observations led the author to conclude that " the evening flight is one of orientation, by which place-memory is established and maintained—the sudden departure at dispersal of the flock affording no opportunity for this function."

The examples of *charithonia* first observed, sleeping or on the wing, in any season were males, which evidently emerged earlier than the females. No difference in the behaviour of the sexes was seen when, later on, they were found mixed on the roosts, nor between that of the groups as a whole whether composed of males alone or of both sexes. For this reason and especially because pairing is known to take place directly after the emergence of the female the author concludes that the group-sleeping habit is unconnected with mating. Still more obviously, as he points

out, it is unconnected with food. There remains the possibility of safety. Admitting that the pattern is not conspicuous on the roost he asks—" But even if protectively coloured—or rather patterned—why should thirty such butterflies sleeping in a compact group be any safer than thirty sleeping singly and far apart? The reverse would seem nearer the truth." Then, referring to the powerful odour, which suggests " the rank sweetness of the Datura blossom," and is emitted by both sexes when handled, and to their slow flaunting flight, the author concludes :— " If Heliconia is protected by a nauseous odor or taste, advertised to its daytime enemies by conspicuous readily-recognised colors and color-patterns, *then* its degree of protection, at night, when these warnings are not so apparent, may be increased by the close proximity of large numbers, under these conditions readily recognizable by form, color, or *scent*, as identical in kind and inedible; for thus the injury or destruction of one of the group might conceivably work for the protection of the many. . . . On the assumption that they [the sleeping-assemblages] are of significance, we have presented a suggested explanation which seems in agreement with the observed phenomena; and for this suggestion we have been unable to discover any reasonable alternative."

The stimulus leading to these assemblages is, the author was led to conclude from the result of his experiments, twofold, being both local and social, the latter more powerful than the former and often overcoming it. Between them they exert a most effective influence in maintaining during sleep a gregarious grouping, the warning significance of which was first suggested by Fritz Müller in " Kosmos," (1877)—a paper summarized by Raphael Meldola in 1878 *Proc. Ent. Soc. Lond.*, **1878 :** vi, vii. The aposematic effect of the simultaneous discharge of an unpleasant odour by a gregarious community was pointed out in 1887 *Proc. Zool. Soc.*, **1887 :** 204.

Prof. Morton Jones has also most kindly given me a list of references to the resting habits of *H. charithonia* and other Heliconines which will be valuable to all who are interested in the subject. Accordant observations from Florida are quoted in the detailed account of *charithonia* given, under Heliconia, by W. H. Edwards in *The Butterflies of North America*, II (1874–78). This volume, in the edition which I have had the opportunity of consulting, is dated 1884, with the pages numbered in pencil. It is here recorded that Wittfeld observed the butterflies in Florida roosting in numbers " on Spanish moss, or on dry twigs of trees, especially such as have dead leaves still hanging to them " (p. 122).* The same naturalist observed and confirmed by repeated observations that the male butterflies are attracted to the female pupa during the two days preceding emergence when the changes in colour become visible. He once found as many as six males clinging to a single pupa and saw others approaching although there was no room to alight. Males could not be induced to leave the pupa by ordinary disturbance and flew back when released after being removed by force. Pairing was effected directly after emergence and sometimes before its completion (pp. 123–127).

A brief note on the habits of these butterflies in the same State is given by

* Also in Dec. 1881, " Papilio," **1**, (11) : 209–215, describing " Certain Habits of Heliconia charitonia [*sic*], L., . . . found in Florida," W. H. Edwards states that " they may be observed after sunset suspended at the ends of twigs and leaves, where they have taken up their station for the night, fully exposed to the attacks of enemies, if they have any."

C. T. Simpson in his book *In Lower Florida Wilds*, 1920. The author observed half a dozen *charithonia* hanging as if dead to a strand of long moss, and once counted 25 within a space of ten inches. He describes them as sometimes burying themselves in the moss, and regards the habit as procryptic (pp. 386–388).

Observations in Costa Rica were recorded by A. S. and P. P. Calvert in *A Year of Costa Rican Natural History* (Macmillan: New York: 1917). In the chapter which describes observations made "near the laguna and down the Reventazón road," Juan Viñas, it was stated that "Four *charithonia* were sleeping on the roots of a tree, exposed by washing away of the soil, by the roadside on April 27 [1910]. Their wings were folded and hanging down, and so dormant were they that A. picked one of the group off while the others only fluttered a short distance and returned to the same roots and the same positions" (pp. 218, 219).

The first known record of the resting habits of *charithonia* is that of Philip Henry Gosse quoted in Doubleday, *Genera of Diurnal Lepidoptera*, I: 97 (1846–50). The gregarious flight as well as the resting groups of *charithonia* in Jamaica are described. "As there were no leaves on the hanging stalks, the appearance presented by these beautiful butterflies, so crowded together, their long, erect wings pointing in different directions, was not a little curious. I was told by persons residing near, that every evening they thus assembled, and that I had not seen a third part of the numbers often collected in that spot."

The aposematic appearance and behaviour of *charithonia* in flight is recorded in Gosse's *Naturalist's Sojourn in Jamaica*, London, 1851, where he wrote of its "brilliant contrasts of colour, lemon-yellow and velvety black, together with the very peculiar flapping of the wings in flight. . . . It is one of the most easily captured of Butterflies, being slow of flight and fearless; it flutters heavily along over low herbage at the sides of roads, and by the sea-shore, rarely mounting as high as one's head, except when alarmed" (p. 27).

Miss M. E. Fountaine, F.E.S., who was then staying at Bath, Jamaica, was told by "Bersa" * and herself confirmed that *charithonia* collected into groups, preferring to rest on dried-up dead twigs, "invariably rejecting all the green leaves." Eight butterflies were seen assembling, and it was also observed that most of them selected the twig on which they had previously rested (1911, *Entomologist*, **44**: 403, 404).

Further evidence from Jamaica was brought forward by Dr. G. B. Longstaff in *Butterfly-hunting in Many Lands*, London, 1912:—On 5 Mar. 1905 at Shotover, near Port Antonio, "at about noon on a dull day, eight or ten were seen flying about under the shelter of a hedge. As many as seven of these settled on dead sticks, etc., within a space of 2 feet by 1 foot." Dr. Longstaff was also told by a resident in the island that these butterflies "'clustered' on going to rest for the

* Miss Fountaine has kindly written from Port of Spain, Trinidad:—"18 *May* 1931.—'Bersa' was my friend and fellow-worker for many years. His real name was Charles Neimy. His death three years ago was a great loss to me and always will be. I remember Mr. Neimy taking me one evening to see this extraordinary assembly of *H. charithonia*, so many more specimens than we ever saw at the same place in the day time, that they must have come from some distance to this unaccountably favoured roosting place; and it happened every evening. I also remember noticing that some of the specimens seemed quite fresh, as though just recently emerged, whereas others were very old and worn."

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night, a number of specimens sitting close together, but not actually clinging to one another" (p. 281).

It is of special interest to know that *charithonia* exhibits the same gregarious habits on going to rest at noon on a dull day as when preparing for the night's sleep.

Being anxious to ascertain whether the same habit is manifested by the southern race *H. charithonia peruviana*, Feld., I inquired of my friend Commander Walker, who had many opportunities of observing it, in 1881–1883, at Callao and Lima. He has kindly informed me that it was most plentiful at Villeguas, about two miles E. of Callao, in a shady lane bounded by high rose hedges adjoining a large garden near Villeguas Railway Station. After about 5.30 p.m.—an hour before sunset—the butterflies settled, in little closely-packed companies of five or six each, on the long trailing shoots of the rose-bushes, and were easily picked off by hand.

The question naturally arises whether the habit of gregarious resting exists, although insufficiently observed, in other Heliconines as well as *charithonia*. There are reasons for an affirmative answer. Thus the author of the *Genera of Diurnal Lepidoptera* (*l.c.*) was informed by G. Dyson that *Heliconius melpomene* and also the Ithomiine, *I. iphianassa*, assemble in groups; but the most complete evidence is that recorded by W. Beebe in the *Atlantic Monthly*, **122**: 238–330, Sept. 1918, and reproduced by the author in *Jungle Peace*, 1919, pp. 203–209, from which the following statements are quoted. The Heliconine butterflies observed were certainly not *charithonia*, which does not occur in British Guiana where Beebe has his Tropical Station, but were of at least two species and perhaps more. He distinguishes them as the Reds and the Yellows and describes them as keeping separate, but collecting and alighting one by one in the same manner "on the very tips of bare twigs, upside down with closed wings." They then became, he considered, "almost invisible," presenting "no surface to the rain of the night, and all faced N.-E.—the certain direction of both rain and wind." He "counted twelve of the Red-spots and eight Yellows on two small bushes and a few minutes' search revealed forty-three more." All hung from tips of bare twigs and when disturbed each returned to its particular perch and settled to rest, and he also believed, kept to its twig night after night. From time to time for two weeks he watched them using the twigs, until at the end only three remained—one fresh and two worn. The author also agrees that these conspicuous butterflies with their flaunting flight are "assuredly" warningly coloured. The gregarious resting-habit he considers "presupposes memory, sociability and caution, manifested at least subconsciously." These observations were made on the "Convict Trail" which, as Mrs. Brindley kindly informs me, is on the Kalacoon Estate, on the opposite side of the Mazzaruni River to Kartabo and Dr. Beebe's Tropical Research Laboratory.*

The numerous observations quoted here, with that of Dr. Myers recorded in 1930 *Proc. Ent. Soc. Lond.*, **5**: 48, prove that *H. charithonia* in Florida, Costa Rica,

* Mr. P. Lechmere Guppy has kindly written from St. Ann's, Port of Spain, Trinidad:—"8 *May* 1931.—I have often observed in different parts of Trinidad Heliconian butterflies assembling about dusk, and 'hanging up' in company at ends of twigs and drooping (pendant) branches—bamboos growing in clumps seemed favourite resorts. I hope to confirm these observations in this locality."

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Jamaica and Cuba, as well as its southern race in Peru, manifests the same gregarious habit and the same preference for dead or leafless twigs or long trailing shoots; also that certain other HELICONINAE have similar habits. This behaviour seems clearly related to that of the male Euploeas observed by Mr. Buxton and Mr. Hopkins in Samoa (*ibid.*, 1926, **1**: 35, 48). The earliest groups of *charithonia* were also composed of males (p. 6), and it is possible that later emergences would have led to mixed sexes in the Samoan assemblages. Further investigation may, however, prove that the female resting habits are always different from those of their males, although in other DANAINAE with gregarious resting habits, such as *Danaida plexippus*, they are known to be similar.

Making all allowance for this difference the striking fact remains that species of two distasteful, much-mimicked groups—the DANAINAE among the most specialised of the NYMPHALIDAE and the HELICONINAE among the least specialised—both exhibit the gregarious resting instinct combined with the instinct to seek dead or bare twigs. It is reasonable to suppose that the similarity in the behaviour of the two groups has been independently developed to meet a similar need—the need for an enhanced aposematic advertisement during periods of rest no less than in periods of activity, when it is manifested by display, flight, etc. This hypothesis, he agreed with Prof. F. Morton Jones in believing, offers a reasonable interpretation of facts which, in the present state of our knowledge, are otherwise inexplicable.

The flight of the common earwig, *Forficula auricularia*, L.

Prof. POULTON said that in reference to a recent communication on the flight of the Common Earwig (1930, *Proc. Ent. Soc. Lond.*, **5**: 41–43) Mr. B. M. Hobby had kindly directed his attention to the following record (1919, *ibid.*, **1919**: xvi):—

Mr. Durrant said "that he had seen and captured one flying round a lamp. Mr. E. E. Green said that though he had not seen them flying he had several times found them floating dead on water in tanks, with the wings spread fully out as in flight. They appear to fly only at night."

These observations were brought forward in reference to an (unreported) discussion at the Zoological Society arising out of the concluding words of a paper, "Some Points in Insect Mechanics," by H. R. A. Mallock, F.R.S.:—

"In the case of earwigs, at any rate of the species found in England, it seems more than doubtful whether the wings are ever used. The thorax only contains traces of flight muscles, and I have not been able to distinguish any folding muscles in the wings themselves.

"The ancestors of the present species probably had working wings which for some reason have now fallen into disuse" (1919, *Proc. Zool. Soc.*, **1919**: 116).

The larva of the Lycaenid butterfly *Liphyra brassolis*, Westw., taken from the nest of the Red Tree-Ant in Assam.

Prof. POULTON exhibited an example of this caterpillar preserved in spirit, sent to him by his friend Mr. E. A. Andrews, Entomologist of the Tocklai Expt. Station, Cinnamara, Assam. The larva had been taken, 21 Feb. 1930, from a nest of the ant *Oecophylla smaragdina*, F., at Jorhat, a large tea-garden centre which, as his

friend Major R. W. G. Hingston had informed him, lies some 70 miles S.W. of Dibrugarh. The caterpillar showed clearly the wonderful carapace-like covering turning under at the sides and protecting all parts of the surface except a narrow mid-ventral area which the ants could not reach. A fine series of imagines and dried caterpillars exist in the British Museum Collection, but the larval form was especially well preserved in the exhibited specimen. The mode of protection was to be compared with that of the Lycaenid larva *Euliphyra mirifica*, Holl., discovered in the nest of the W. African race, *longinoda*, Latr., of *Oecophylla smaragdina*, in the Lagos district, by Dr. W. A. Lamborn, O.B.E., and described by Dr. Eltringham in 1913, *Trans. Ent. Soc. Lond.*, **1913 :** 509, pl. xxviii. The habits of the larva and its relation to the ants were recorded by Dr. Lamborn in the same memoir (pp. 450–456).

Major Hingston had informed him that the only Lycaenid larva he had found associated with *Oecophylla* in the East was *Zesius chrysomallus*, Hübn., which was unable to feed by itself and died when separated from the ants.

The Sphecid wasp *Mimesa* (*Psen*) *bicolor*, Jur., capturing parasitised Jassid prey.

Mr. B. M. Hobby exhibited specimens of *Mimesa* (*Psen*) *bicolor*, Jur., together with its Jassid prey. He said that they were taken by Mr. F. J. Killington and himself at Hengistbury Head, near Christchurch, Hampshire, on 31 August, 1930. Two species of prey were represented, comprising seven *Paramesus nervosus*, Fall. (5 ♂♂, 2 ♀♀), and nineteen *Athysanus sejugendus*, Kbm. (9 ♂♂, 10 ♀♀). Not one of the former species was parasitised, but of the latter seven males and seven females showed the presence of Hymenopterous parasites protruding from the region of the second thoracic segment. These were the black larval sacs of a Dryinid, possibly of the genus *Antaeon* (*vide* Fig. 8, Haupt, H., 1916, *Z. Wiss. InsektBiol.*, **12 :** 221). The parasite probably influenced the activity of the Jassids so that they were more easily caught by the wasp than were normal ones, and this would explain the exceedingly high percentage of parasitised individuals (nearly 74% in the case of *Athysanus*). By catching such infected bugs, the wasp would reduce the numbers of the Dryinid, and, as these parasitised individuals would die in any case, the Jassid would therefore appear to benefit. This conclusion was identical with that of Hamm and Richards (1926, *Trans. Ent. Soc. Lond.*, **74 :** 313), based on observations involving a Crabronid, a Typhlocybid and a species of parasite probably belonging to a different Dryinid genus. On one particular occasion they found that 66% of the prey were parasitised. These observations illustrated the principle that although the economic control of pests by several parasites and predators may often be advantageous, such a result by no means necessarily follows, for the attacks of one set of enemies may seriously weaken the attacks of the other set. This point had been reviewed critically for the parallel problems of multiparasitism by H. S. Smith, 1929, *Bull. Ent. Res.*, **20 :** 141–149.

How are the tracheae of insects kept full of air ?

Dr. Wigglesworth said that the fact that the tracheae of insects are kept filled with air is usually accepted without questioning the mechanism by which

it is accomplished. The problem was discussed by Thomas Graham nearly a century ago, but in those days many of the physical factors involved were unknown, and his conclusions are therefore quite invalid. The matter was considered again by Lubbock in 1860, who repeated the arguments of Graham, but since that time the very existence of the problem has been almost entirely overlooked.

The difficulty arises from the extreme fineness of the terminal tracheal capillaries or tracheoles; for it is well known that, by virtue of the force of "capillarity," fluid has a strong tendency to flow up fine tubes, and, in the case of tubes of the size of the tracheal capillaries, this force will be the equivalent to many atmospheres pressure. Hence it is that very soon after the death of the insect, fluid can be seen rising higher and higher up the tracheal capillaries.

Why does this not happen during life? What force is holding back the fluid? I have recently obtained evidence that the force in question is the osmotic pressure of the tissue fluids. Thus, suppose that the walls of the tracheoles during life are permeable to water (which they certainly are) but not permeable to the substances dissolved in the water. Then, the water will enter the tubes and will be drawn along them by capillarity until the attraction of the dissolved substances outside the tube, in other words the osmotic pressure, holds it back.

The evidence for this view is briefly as follows. If a living mosquito larva (*Aëdes argenteus*) be examined under the microscope, the tracheal endings in the head can be seen to contain air up to a point, and then to contain fluid. If the larva is now asphyxiated by holding it away from the water surface, it contracts its muscles violently, and in a few minutes the fluid is absorbed from the tracheoles and the air extends further along them. Now it is well known that muscular contraction causes an increase in osmotic pressure. More direct evidence can be obtained by pricking the side of the head of the larva and adding fluids of varying osmotic pressure. If these are of greater osmotic pressure than the tissue fluids, the air advances further down the tubes. If they are of lower osmotic pressure, the air remains stationary or retreats.

A full description of these and other experiments by which this theory is supported has been published in 1930 *Proc. Roy. Soc. Lond.* (B), **106**: 229–250; and a further discussion on the first appearance of air in the tracheae at the time of hatching from the egg in 1931 *Quart. J. Micr. Sci.*, **74**: 165–192.

Wednesday, March 4th, 1931.

Dr. H. Eltringham, F.R.S., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society:—D. J. Lewis, Trinity College, Cambridge, and R. B. Tweedie, "Blandfords," Chartridge, Chesham, Bucks.

Obituary.

The deaths of Father Erich Wasmann (an Honorary Fellow of the Society), and of Mr. J. W. Bowhill, were announced.

Exhibits.

Butterflies from Bavaria.

Mr. Higgins exhibited some butterflies from Bavaria, amongst those of special interest being a form of *Agriades glandon*, de Prunn., from the Nebelhorn in the Algäu. This is characterised by the very pale tone of the under surface of the wings and the almost complete obsolescence of the usual black spots. In this respect there is a remarkable approach to *A. glandon aquilina*, Stdgr., from Lapland. The Bavarian race was very well figured by Freyer, whose specimens probably came from the Schlicke Alps near Füssen. It was again figured in 1853 by Gerhardt under the name *L. orbitulus* var. *aquila* from specimens sent to him by Freyer. Subsequently the race was overlooked until 1925, when Osthelder called attention to it and described it as an unnamed race *bavarica*. Although the earlier name differs so little from *aquilo*, Bdv., 1832, it is not strictly a homonym and may be allowed to stand.

The Bavarian *aquila* has a very restricted distribution. It occurs on most of the higher peaks of the Algäuer Alps, and according to Osthelder in other parts of the northern "Chalk Alps" as far east as Innsbruck. *A. glandon* is such a constant species throughout the rest of its Alpine range that it is really very curious to find such a constant and marked race as *aquila* occurring in a relatively small and isolated area.

The Prey of *Coenosia tigrina*, F., and other Species of the Genus.

Mr. B. M. Hobby exhibited specimens and prey of *C. tigrina*, *C. intermedia*, *C. humilis*, *C. lineatipes* and a *Coenosia* sp. indet. He said that taking into consideration three previously published records, the prey of *C. tigrina* consisted of 3 Hemiptera and 50 Diptera—Anthomyiidae predominating. The insects captured were usually larger and more robust than were those taken by *C. humilis* (*vide* Evans, A. M., 1930, *Trans. Ent. Soc. Lond.*, **74**: 325–9), a difference doubtless due to the larger size of *C. tigrina*. Females were more frequently found with prey than were males, the proportion (43 ♀♀, 9 ♂♂ and 1 sex indet.) being almost identical with that recorded for *C. humilis*. The victims of the remaining species were all Diptera. Help in identification had been kindly given by Messrs. J. E. Collin, A. H. Hamm and Dr. F. W. Edwards.

Prey of *Coenosia tigrina*, F. † by captor ? sex, * by ♂, others by ♀.	Locality, Date and Observer.
Diptera : Cecidomyidae.	
1. Cecidomyid sp., ♀.	Lye Hill, near Cowley, Oxford. 19.vi.09.—A. H. Hamm.
Mycetophilidae.	
2. *Sciara carbonaria*, Mg., ♀.	In garden of 22, Southfield Rd., Oxford. 12.ix.09.—A. H. Hamm.
3. *Docosia valida*, Winn.	Lyndhurst, New Forest. 30.v.07.—F. C. Adams.
4. *Mycetophila* sp., ♀.	Hogley Bog, near Cowley, Oxford.—2.x.26.—A. H. Hamm.
Bibionidae.	
5. *Dilophus febrilis*, L., ♂.	Lye Hill, Oxford. 5.ix.09.—A. H. Hamm.
6. ,, ,, ♂.	,, ,, ,, ,, ,,
7. ,, ,, ♂.	Hogley Bog, Oxford. 11.ix.15.—A. H. Hamm.
8.† ,, ,, ♀.	On *Angelica* flower, Kenton, Suffolk. 27.viii.09.—C. Morley.—1910. *Ent. Mon. Mag.*, **46**: 143.

Prey of *Coenosia tigrina*, F. † by captor ? sex, * by ♂, others by ♀.	Locality, Date and Observer.
Chironomidae.	
9. *Metriocnemus fuscipes*, Mg., ♂.	Lye Hill, Oxford. 19.vi.09.—A. H. Hamm.
Psychodidae.	
10. *Psychoda alternata*, Say., ♀.	On Michaelmas Daisy, in garden, Calderstones distr., Liverpool. 7.45 p.m., 28.viii.26.—A. M. Evans.—1930, *Trans. Ent. Soc. Lond.*, **78** : 327.
Limnobiidae.	
11. *Molophilus obscurus*, Mg., ♀.	In garden, 22, Southfield Rd., Oxford.—26.v.18.—A. H. Hamm.
12. *Limnophila ochracea*, Mg., ♂.	Gipsy Lane, near Oxford. 23.vi.17.—A. H. Hamm.
Rhyphidae.	
13. *Rhyphus punctatus*, F., ♂.	Stradbally, Waterford, S. Ireland. 24.vi.07.—H. W. Andrews.
Empidae.	
14.* *Empis nuntia*, Mg., = *pennaria*, Flu., ♀.	In garden, 22, Southfield Rd., Oxford. 26.v.18.—A. H. Hamm.
15. *Tachista connexa*, Mg., ♂.	Ross, Herefordshire. 19.vi.02.—J. W. Yerbury.—1906, *Trans. Ent. Soc. Lond.*, **1906** : 391.
16.* *Tachydromia* sp. ? *agilis*, Mg., ♀.	Lye Hill, Oxford. 12.vi.09.—A. H. Hamm.
Dolichopodidae.	
17. *Gymnoternus celer*, Mg., ♂.	Stradbally, Waterford, S. Ireland. 26.vi.07.—H. W. Andrews.
18. *Chrysotus* sp. ? *femoratus*, Zett., ♀.	Bayswater Mill, near Headington, Oxford. 8.vi.18.—A. H. Hamm.
19. *Chrysotus* sp. ? *gramineus*, Fln., ♀.	In garden, 22, Southfield Rd., Oxford. 21.vi.08.—C. H. Hamm.
Lonchopteridae.	
20. *Lonchoptera* sp., ♀.	Lye Hill, Oxford. 5.vi.09.—A. H. Hamm.
Tachinidae.	
21. *Pollenia rudis*, F., ♂.	Tubney Wood, Berkshire. 28.vi.09.—A. H. Hamm.
Anthomyiidae.	
22. *Coenosia lineatipes*, Zett., ♂.	Museum grounds, Oxford. 12.viii.25.—A. H. Hamm.
23. ,, ,, ♀.	Lye Hill, Oxford, 19.vi.09.—A. H. Hamm.
24. ,, ,, ♀.	,, ,, ,, ,, ,,
25. *Coenosia rufipalpis*, Mg., ♀.	Shotover Hill, Oxford. 30.vi.17.—A. H. Hamm.
26. *Coenosia* sp., ♀.	Porthcawl, S. Wales. 26.v.03.—J. W. Yerbury.
27. *Delia* sp. ? *cilicrura*, Rond., ♀.	Farnham Royal, Bucks. 29.vii.29.—D. J. Lewis. Caught beneath glass verandah and retained prey long after capture.
28.* *Chortophila trichodactyla*, Rond., ♂.	In garden, 22, Southfield Rd., Oxford. 31.v.08.—C. H. Hamm.
29.* *Chortophila* sp., ♀.	Shotover Hill, Oxford. 29.viii.09.—A. H. Hamm.
30. ? *Chortophila* sp., ♂.	In garden, 22, Southfield Rd., Oxford. 14.vi.14.—A. H. Hamm.
31. *Paregle radicum*, L., ♂.	In garden, 22, Southfield Rd., Oxford. 2.vi.08.—C. H. Hamm.
32. *Helina communis*, Dsv., ♂.	Shotover Hill, Oxford. 19.viii.16.—A. H. Hamm.
33. ,, ,, Dsv., ♂.	Swaythling, Hampshire, 6.ix.30.—B. M. Hobby and F. J. Killington.
34. ? *Hebecnema* sp., ♂.	University Parks, Oxford. 22.viii.27.—A. H. Hamm.
35. *Azelia cilipes*, Hal., ♂.	Hogley Bog, Oxford. 11.ix.15.—A. H. Hamm.
36. *Fannia armata*, Mg., ♂.	Lye Hill, Oxford. 19.vi.09.—A. H. Hamm.
37. *Fannia* sp., ♀.	Stradbally, Waterford, S. Ireland. 27.vi.07.—H. W. Andrews.
38. *Lasiops semicinereus*, Wied., ♂.	Shotover Hill, Oxford. 20.vi.08.—C. H. Hamm.
39. *Polietes albolineata*, Flu., ♂.	Headington Hill, Oxford. 15.ix.17.—H. Britten.

Prey of *Coenosia tigrina*, F. † by captor ? sex, * by ♂, others by ♀.	Locality, Date and Observer.
Sapromyzidae.	
40.* *Sapromyza* sp. ? *fasciata*, Fln. or *subvittata*, Lw., ♀.	Lye Hill, Oxford. 7.vi.08.—A. H. Hamm.
Opomyzidae.	
41. *Opomyza germinationis*, L., ♀.	Shotover Hill, Oxford. 30.vi.17.—A. H. Hamm.
42*. ,, ,, ♀.	Longdown, New Forest. 7.ix.30.—B. M. Hobby and F. J. Killington.
Sepsidae.	
43. *Sepsis cynipsea*, L., ♂.	Stradbally, Waterford, S. Ireland. 23.vi.07.—H. W. Andrews.
Ephydridae.	
44. *Hydrellia griseola*, Fln., ♂.	Shotover Hill, Oxford. 30.vi.17.—A. H. Hamm.
45.* ,, ,, ♀.	,, ,, ,, ,, ,,
Phytomyzidae.	
46. *Phytomyza* sp., ♂.	Lye Hill, Oxford. 19.vi.09.—A. H. Hamm.
Borboridae.	
47. *Limosina vagans*, Hal., ♀.	In garden, 22, Southfield Rd., Oxford. 28.v.17.—A. H. Hamm.
48.* *Limosina pumilio*, Mg., ♀.	Newmarket, Suffolk. 23.vi.10.—J. E. Collin.
Phoridae.	
49. *Phora incrassata*, Mg., ♂.	Lye Hill, Oxford. 5.ix.09.—A. H. Hamm.
50. *Phora nitidula*, Mg., ♀.	In garden, 22, Southfield Rd., Oxford. 7.vi.08.—C. H. Hamm.
Homoptera : Jassidae.	
51. *Cicadula sexnotata*, Fln., ♀.	In garden, 22, Southfield Rd., Oxford. 13.vi.09.—A. H. Hamm.
Homoptera : Fulgoridae.	
52. *Liburnia pellucida*, F., ♀.	In garden, 22, Southfield Rd., Oxford. 2.vi.08.—C. H. Hamm.
Heteroptera : Capsidae.	
53.* *Plagiognathus arbustorum*, F., ♂.	Wick Copse, near Headington, Oxford. 21.viii.15.—A. H. Hamm.

1. *Coenosia humilis*, Mg., ♂, with *Sciara* sp., ♀: Lyndhurst, New Forest. 15.vii.07. —F. C. Adams.
2. *Coenosia intermedia*, Fln., ♂, with *Empis aestiva*, Lw., ♂; Bonhill, Dumbarton. 27.vii.07.—J. R. Malloch.
3. *Coenosia intermedia*, Fln., ♀, with Dolichopodid fly *Argyra argentina*, Mg., ♀: Bonhill, Dumbarton. 10.viii.07.—J. R. Malloch.
4. *Coenosia lineatipes*, Zett., ♀, with Cecidomyid sp., ♂: University Parks, Oxford. 12.ix.27.—A. H. Hamm.
5. *Coenosia* sp., ♀, with *Sciara* sp., ♀: Hogley Bog, Oxford. 6–6.30 p.m., 4.vii.14. —A. H. Hamm.
6. *Coenosia decipiens*, Mg., ♀, [*pedella*, Fln.] with *Sciara* sp., ♀: "Sitting on a post in the salt marshes," Buss Creek, Southwold, Suffolk. 6.ix.07.—C. Morley.—1910, *Ent. Mon. Mag.*, **46**: 143.

ANTHOMYIIDAE observed sucking insect juices.

Mr. B. M. HOBBY said that the Anthomyiids exhibited were observed in the act of sucking insect juices, but there was no direct evidence that they had captured living prey. As regards *Limnophora*, it was also to be noted that it is related to *Lispa*, a genus known to prey upon CULICIDAE. Furthermore, of the exhibited specimens *Limnophora* alone was predacious in the larval stage and such larvae were often known to develop into predacious imagines.

1. *Hylemyia strigosa*, F., ♀, with a small Lepidopterous larva contained in a folded leaf: Lye Hill, Oxford. 12.v.12.—A. H. Hamm.
2. *Pegomyia bicolor*, Wied., ♂, with the Leptid fly *Chrysopilus aureus*, Mg., ♂: Hogley Bog, Oxford. 2.30–4.30 p.m., 19.vii.08.—A. H. Hamm.
3. *Pegomyia* sp. near *bicolor*, Wied., ♀, with a dead Capsid bug *Calocoris infusus*, H. Schf., ♂: Mumbles, Glamorgan. 29.viii.08.—J. W. Yerbury. The bug was wrapped in silk and had evidently been killed by a spider.
4. *Limnophora denigrata*, Mg., ♀, with the Jassid *Dicraneura* sp. ? *similis*, Edw., ♂: Bonhill, Dumbarton. 29.viii.07.—J. R. Malloch.
5. *Limnophora denigrata*, Mg., ♂, with the Homopteron *Psyllia alni*, L., ♂: Bonhill, Dumbarton. 27.vii.07.—J. R. Malloch.
6. *Helina impuncta*, Fln., ♀, with the Empid fly *Tachydromia agilis*, Mg., ♂: Lye Hill, Oxford. 29.v.09.—A. H. Hamm.
7. *Ophyra leucostoma*, W., ♀, with the fly *Borborus equinus*, Fall., ♂: Christchurch, Hampshire. 13.vi.97.—J. W. Yerbury.

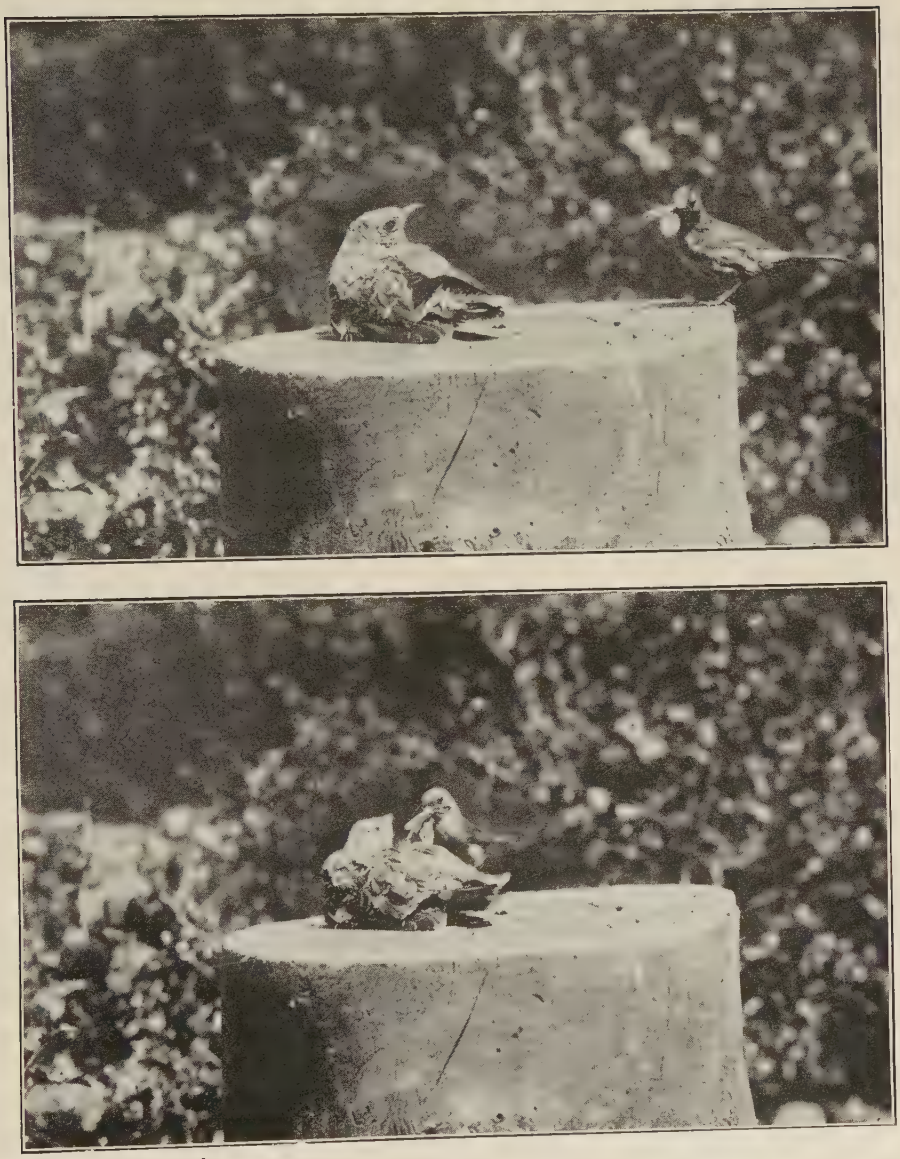
***Ochthera mantis*, De G. (Dipt., EPHYDRIDAE) with a Chloropid fly as prey.**

Mr. B. M. HOBBY exhibited a male *Ochthera mantis* taken by Dr. C. G. Lamb, in the New Forest, August 1910, with the Chloropid fly *Oscinis* sp., ♂, as prey.

The Meadow Pipit (*Anthus pratensis*, L.), feeding a young Cuckoo on *Pieris rapae*, L.

Prof. POULTON exhibited on the screen the two photographs of a Hedge-sparrow fosterer and young Cuckoo shown and described in 1930 *Proc. Ent. Soc. Lond.*, **5**: 85, and reproduced in the accompanying Plate 1 of Vol. **6**. He also exhibited on the screen the striking photograph reproduced in Plate 2, showing the fosterer, a Meadow Pipit, perched on the back of the Cuckoo and carrying a *P. rapae*, afterwards eaten by the young bird. The latter was seated on the hand of Mr. A. G. Britten, who was offering a green caterpillar. The photograph was taken in his garden at Skirwith, Cumberland, by Mr. Britten, as explained in the following interesting notes quoted from a letter to his brother, Mr. Harry Britten, F.E.S.:—

"As regards the Cuckoo and the *Pieris rapae* it was not at all uncommon that when I fed the young Cuckoo myself, the Pipit, in her evident excitement or uneasiness at my presence, grabbed any stray insects that were on the move near at hand. I remember on one occasion she had quite a mouthful of craneflies, and, as a Meadow-Brown flew past, she swooped on to it and added it to the pile. I think it was often done to allay her fears and was so on the occasion of this photograph. She had at first only craneflies in her beak, and I remember seeing her fly



H. F. Chittenden, phot.

Above, the fosterer, a Hedge-sparrow, approaching with a captured "Small Garden White".
Below, about to feed the young Cuckoo. Seaford, Sussex, 29 June, 1930.

A. G. Brisco, phot.

Young Cuckoo about to take a green caterpillar. The fosterer, a Meadow Pipit, was alighted with a "Small Garden White" which it afterwards gave to the Cuckoo. Skirwith, Cumberland, 24 July, 1929.

A. G. Britten, phot.

The young Cuckoo, figured in the last plate, being fed 24 days later, having grown considerably in the interval. The butterfly is probably a fine female "Small Garden White." Skirwith, Cumberland, 17 August, 1929.

off to the Brussels sprouts which were only a few feet away and return with a butterfly, and I believe it was the flapping of the butterfly's wings that partly took her attention, so that she alighted on the young Cuckoo.* As to the method of feeding, butterflies, like craneflies, were pushed far into the gullet, wings and all. I myself pushed great Yellow Underwings well into the throat of the Cuckoo, and they seemed much to the youngster's enjoyment. I have another negative somewhere which shows the Meadow Pipit pushing a butterfly into the Cuckoo's gullet, and I fancy it must have been a *P. brassicae*,† as the white wings were so prominent in the picture [reproduced in Plate 3]. The principal diet of this young Cuckoo was made up of craneflies, but I also saw several small moths eaten. I used to offer all kinds of caterpillars (smooth green ones and large hairy ones), also leather-jackets, and as long as they were pushed well back they were swallowed, but if not were discarded, whatever the species."

A little later Mr. Britten kindly sent me the following additional details :—

" 14 *March*, 1931.—I used to feed the young Cuckoo with any living thing I could get hold of. When the photo was taken I was giving it a green caterpillar off the Pea rows, exactly what species I do not know. I used to carry it round the garden on my hand and give it any caterpillar I could find on the trees or plants. The Pipit gave the butterfly—a Small White, I think—to the Cuckoo after the photo was taken. She always used to allay her fears or anxiety by collecting an enormous quantity of insects when I was trying to persuade her to feed the Cuckoo on my hand or sitting near to me. I arranged a rough ' hide,' so that my little girl and my wife could see it being fed. It was strange that I could feed the Cuckoo quite openly, but it was not at all friendly when others were watching. My camera was a Thornton Pickard, controlled by a long tube with the bulb under my foot or knee according to circumstances. Long after the Cuckoo had flown from the nest I used to go to it sitting on the fence or gate and feed it, but it would not allow any one else near. I put two rings on it, one on each leg. I intend to look up the numbers and let them be known. As the nest was in my garden I was able to visit the bird many times in the day. After it had left us for the moor, it would come flying to meet me when walking across, and I had the pleasure of seeing and touching it in September. During the earlier period in my garden I took notes and a photograph daily for three weeks and a few afterwards. The photograph reproduced on Plate 2 was taken on 24 July 1929, about the 28th day, and that of Plate 3 on 17 August, 24 days later."

That the fears of the fosterer should have led to an intensive capture of prey for the young Cuckoo threw light on a very interesting aspect of bird psychology, also illustrated by an observation, quoted by the late Prof. E. B. Tylor, of a bird, he believed a thrush, which saw, in the midst of a song, one of its young seized by a cat, and expressed the emotions of fear and anger by singing with redoubled vigour and passion.

* I believe it is not uncommon for a relatively small fosterer to alight on the back of the Cuckoo before feeding it.—E. B. P.

† Capt. N. D. Riley agrees with me that the butterfly shown on Pl. 3 is probably a very large female *P. rapae*. The outer margin of the R.F.W. has been shorn away, evidently by a bird's beak.—E. B. P.

British Moths eaten by Bats.

Prof. Poulton said that he had recently met with a few species of moths eaten by bats, in addition to those recorded in 1929 *Proc. Zool. Soc.*, **1929 :** 277 (especially the Table on pp. 284–5). His friend Dr. A. R. Jackson had directed his attention to Mr. T. Ashton Lofthouse's paper in 1931 *Vasculum*, **17 :** 4, recording the names of moths identified by their wings dropped (1925) in the porch of his house at Middlesbrough. The following records were new to him :—the Noctuids, *Hadena glauca*, Hübn., *H. thalassina*, Rott.; the Geometrid, *Odontopera bidentata*, Cl.; the Hepialid, *H. lupulinus*, L.; and the Notodont, *Pheosia tremula*, Cl. (*dictaea*, L.). It was probable that the Long-eared Bat (*Plecotus auritus*, L.) was responsible.

His friend Mr. W. Parkinson Curtis, F.E.S., had also found *Pheosia tremula* freely captured by bats at Parkstone, although he himself had been unable to take the species in that locality. The following note described the circumstances in which *tremula* was identified :—

" 1931, *Mar.* 1.—Several specimens have been destroyed here in my backyard. I find the wings on the bricks of the yard in the morning. The culprit is, I believe, the Greater Horseshoe Bat, which breeds in the roof of my house, and immature specimens of which occasionally find their way into the house through a top light on the staircase. (I don't know the bats well, but they comply with skins labelled Greater Horseshoe by F. O. Pickard-Cambridge.) I should imagine from the position the wings are always found in that the bats hang up on a clothes line to eat the insects."

Here too it would be interesting to determine the species of bat with certainty. The behaviour suggests the Long-ear.

Attacks of Birds upon British Moths.

Mr. C. N. Hawkins exhibited a specimen of *Discoloxia* (*Asthena*, *Euchoeca*) *blomeri*, Curt., taken on the 12th July last at rest on the trunk of a tree at Cheneys, near Chalfont Rd., Bucks. The moth bore evident beak-marks as described by Prof. Poulton, who showed the specimen on 15 October last (1930, *Proc. Ent. Soc. Lond.*, **5 :** 86). It was again exhibited, together with the following, because a glass-bottomed box had been provided so that the beak-marks could be clearly seen against the light.

The second specimen exhibited by Mr. Hawkins was *Cidaria* (*Epirrhoë*, *Xanthorhoë*, *Melanippe*) *galiata*, Schiff, netted in June 1927 at Sidmouth, Devon. The left fore-wing bore two distinct imprints of a bird's beak directed obliquely from the costa backwards, and the left hind-wing was damaged at the margin.

Mr. Hawkins also read the following note on attacks by birds on *Brephos parthenias*, L.:—On or about the 28th March last year, when walking along one of the paths through the woods on Wimbledon Common, I put up a specimen of *B. parthenias* from the ground near where the path opened out into a small glade. The insect flew along the path, rising as it went, and just as it reached the open a bird darted out from a tree, appeared to reach the moth, and then turned sharply back into the trees again. There was a distinct " snap " as the bird turned, but I think this may have been caused by its wings, as the sound seemed too loud to have been made by the bird's beak. Probably the bird saw me and that may

have spoilt its aim, but, whatever the cause, it failed to capture the moth, which flew away, and the bird made no further attack. The bird appeared about the size of a thrush, but the whole attack and retreat was carried out so quickly that I could not identify it certainly. Later on I saw another specimen of *parthenias* flying about the tops of some birches, when it was attacked by a small bird which flew after it for several yards. The bird in this case made three or four attempts to seize the moth, but the insect was dodging rapidly from side to side and each time the bird missed its stroke. The bird then ceased its pursuit and the moth flew away. I do not think there was any possibility of disturbance in this case.

Prof. POULTON said that he had heard the snap of a bird's bill when it was attempting to seize a moth. The sound was surprisingly loud and was easily heard at a considerable distance.

A Peruvian Lycaenid Butterfly eaten by a Bird.

Commander WALKER exhibited a Lycaenid *Callicista davara*, Hew., taken at Callao and similar to the insects which form the subject of the following note extracted from his diary for 25 April, 1881 :—" In the weedy place outside the north end of the town [Callao] was a little surprised to see a pair of the pretty little angular-winged *Thecla*, which I had as yet only seen at La Legua [3 miles distant]. One of these I secured, the other was snapped up by a passing swallow."

The "False Head" of many Colombian Lycaenid butterflies observed by G. Salt, D.Sc. ; also mimicry of Aculeate models by Colombian moths.

[Prof. POULTON exhibited the specimens described in Dr. Salt's interesting notes printed below. In the determinations much kind help had been given by Dr. J. Bequaert, Mr. E. Meyrick, F.R.S., Capt N. D. Riley, and Mr. W. H. T. Tams. It was of much interest that the "false head" should have been once again recognised—and in many species—by an observer unaware of the earlier records. Determinations and notes added to Dr. Salt's paper were enclosed in square brackets. E. B. P.]

While in the Santa Marta region of the Republic of Colombia three years ago, I made a few observations on the movement of their "tails" by butterflies. I have since learned what I did not then know, that the phenomenon has already been frequently observed and described. Although my observations are not new, I venture to assume that my notes and specimens may be of interest to you or of use in your collection and therefore place both at your disposal.

N. 316. [*Arawacus togarna*, Hew., ♀.*] 8.xii.26, Orihueca, Colombia. A small butterfly noticed on a branch of a shrub, only a few inches above the ground. As I attempted to take it with a bottle, I found that I was mistaken as to its orientation, what I had thought the anterior end being actually the posterior. This error was quite natural, for the structure and coloration of the insect is very deceptive.

First, there is a pair of "tails," black except for the white tips. These are bent inwards and therefore cross each other. When at rest the insect slowly rubs

* In this and other similar instances the labels on the specimens correspond with the data recorded in the notes.—E. B. P.

its hind-wings up and down. The long "tails" catch on each other and on a pair of short stiff "tails" above them. To their slow up-and-down movement there is thus added a flicker of the white tips as the "tails" slip over each other. The crossing of the "tails," their coloration and their movement, combined, make them resemble antennae to an extraordinary degree.

Secondly, although the hind-wings are held upright in repose, a small part immediately below the "tails" is twisted at right angles and lies horizontal. These little flaps are blackish with white spots, of which the largest resemble eyes.

Thirdly, the lines of black and white on the underside of the wings, with two dashes of reddish brown, are so arranged that they lead the eye directly to the posterior end and to this false head.

There are, then, several details of form, colour, and movement that cause the posterior end to resemble a head, while the general ensemble heightens the deception by focussing attention on those details. To all appearances, the posterior part has become the anterior.

What use is this? The coloration underneath is warning. But the insect could be alarming without its apparent change of orientation. Why should it appear back to front? At any rate, deceived by these details, I missed the butterfly on my first attempt to take it with the bottle. Are lizards likewise deceived?

In addition to the original specimen there are three others, two of which, as labelled, were observed moving the hind wings up and down. [A ♂ and ♀ of *A. togarna*, labelled respectively, 21.vi. and 19.vii.27, Sevilla, the latter bearing the note—"Moving hind-wings, posterior looks very like the front!" The third Lycaenid with a similar but much coarser pattern of fewer, broader streaks and spaces is *Cyenus aufidena*, Hew., ♂, from Santa Marta, 17.vii.27, bearing the note—"Moving hind-wings up and down." The above-described characters directing attention to a false head at the posterior end of these Lycaenids are further strengthened by the extremely small size of the true head with its slender and inconspicuous antennae.]

N. 318. [*Pseudolycaena marsyas*, Clerck, ♂.] 16.xii.26, Rio Frio, Colombia. Took another butterfly of which the "tails" are crossed and are moved up and down, while the insect is at rest, by vertical movements of the hind-wings. At the anal angle of the posterior wings, underneath, is a large, round, black dot in a white area backed by bluish; and a small black tip turns out horizontally. Again, in this insect, attention is attracted to the posterior end as if it were the head.

N. 336. [*Tmolus echion*, L. (= *basalides*, Hübn.), ♀.] 14.iv.27, Rio Frio, Colombia. Watched a small Lycaenid butterfly in the garden. Each posterior wing bears a long flexible "tail," and just above it another, shorter and more rigid. Beside and below these are two "eye-spots," yellow and black, not very conspicuous but certainly more clearly defined than any of the marks at the anterior end of the body. While I watched, the butterfly almost continuously rubbed the posterior wings up and down against each other. First the long left "tail" would catch on the shorter right one, the former twitching suddenly as it passed; then the right and left long "tails" would cross each other and both move; then the right long "tail" would catch on the left short one, slip over it, and twitch. In its entirety the effect produced was an alternate up and down movement of the

long " tails," which therefore looked more or less like antennae. This movement, combined with the " eye-spots," attracts attention to the posterior end of the body and tends to make it seem the anterior part.

N. 345. [*Calycopis sangala*, Hew., ♀; *C. beon*, Cram., ♀; *Tmolus echion*, L., ♀, all bear N. 345 and 2.vii.27.] 2.vii.27, Rio Frio, Colombia. Three small Lycaenid butterflies observed in repose to move the posterior wings up and down, causing a movement of the long " tails " as described in N. 336. The long " tails " are naturally crossed when the insect is settled. The commoner species has red markings at the base of the " tails " which definitely attract attention to the posterior end of the body.

The three unnumbered Lycaenid butterflies are without special notes, but, as the labels indicate, were observed moving the hind-wings and " tails " up and down. [The three specimens are *Tmolus thulia*, Hew., 19.ix.27, Rio Frio, 2 ♀♀: " moving tails "; and *Tmolus palegon*, Cram., ♀, 26.v.27, Sevillano: " moving tails." *T. thulia* has a black eye-spot within a broad orange-red marginal half circle.]

N. 320. [The Erycinid, *Rhetus arcius*, L., ♀.] 1.i.27, Rio Frio, Colombia. Noticed what seemed to be a new Psammocharid, its long legs trailing behind as it flew. It settled, but with the " legs " held up and twitching. When I took it I found it was an Erycinid butterfly with long, very conspicuous, shining-blue tails.

N. 314. [Probably a *Podosesia* or allied new genus.*] 23.xi.26, Rio Frio, Colombia. An Aegeriid taken flying about *Hibiscus rosa-sinensis* in company with a species of *Polybia* (*Polybia occidentalis*, Olivier, det. J. Bequaert) which it closely resembles.

N. 321. [The Syntomid moth, *Pseudosphex strigosa*, Druce, ♂.] 9.i.27, Rio Frio, Colombia. Took, as I thought, a specimen of the stubby black *Polybia* (*Megacanthopus ater*, Olivier, det. J. Bequaert), avoided its sting, glanced at it in the bottle, emptied the bottle at the house still believing it to be a Vespid, and found that the catch was a Lepidopteron. It is a very good mimic! [The comparison between this and the following species of the same genus is extremely interesting, the body-form being evidently modified in correspondence with the difference between a short, stout-bodied Aculeate model and a comparatively slender one.]

Finally, there is a moth [the Syntomid, *Pseudosphex* sp. ? *klagesi*, Rothsch.] taken at Rio Frio, 2.vii.27, on which I have no special note. It is, however, a very good mimic of a wasp, fairly common in the region, of which I have not yet received an identification. I shall send you the name of the model in a few weeks when Dr. Bequaert has determined it.—George Salt, 28 January, 1931.

[Thinking it would be interesting to ascertain how far these striking adaptations were independent of local conditions I inquired of Dr. Salt, who kindly replied as follows :—]

* Mr. Meyrick kindly examined the specimen and wrote 12.iii.1931 :—" The insect sent (certainly remarkably wasp-like in character) is probably undescribed; probably a *Podosesia* or allied new genus, but the scaling of palpi is abraded. The head, palpi, and thorax are practically quite denuded, and although the species could be recognised if we had to compare it with known species, I do not consider that it can be satisfactorily described, which I regret."

The Santa Marta region includes such diverse ecological stations that to answer your question simply with the position and altitude of the five localities might be misleading. I shall therefore try to describe their situation a little more fully.

The river Magdalena flows northwards into the Caribbean Sea through great swamps surrounded by a sandy, flat, alluvial plain. To the east this plain is abruptly limited by the Sierra Nevada de Santa Marta, which rises wall-like and almost without the usual foot-hill formations to an altitude of 18,000 ft. Owing to the influence of this range on the winds and rainfall, severe xerophytic conditions are produced to the west. To the great altitudinal variation of the region, from a plain at sea-level to snow peaks within ten miles horizontal distance, there is therefore added a great variation in water conditions, from swamps at the river and rain forests in the mountain valleys to grassland at the base of the hills and a strip of true sandy desert on the alluvial plain bordering the swamps.

Sevillano is west of the mountains on the arid plain, at sea-level. Specimens of my collecting so labelled belong to the xerophytic fauna. Rio Frio, Orihueca, and Sevilla are also west of the mountains and also at about sea-level, but belong to the grassland zone where there are pronounced wet and dry seasons, but where the latter are tempered by numerous short streams from the mountains. The three are about equidistant from the swamps and differ only in latitude, Rio Frio being about 10, Orihueca 15, and Sevilla 20 miles south of the nearest true coast. Santa Marta is off the alluvial plain and lies to the north of the mountains where they descend abruptly into the sea. It is at sea-level, lies in a valley surrounded by mountains except on the sea (north) side, and has pronounced wet and dry seasons. Thus, although the five localities are within forty miles of each other and are all at sea-level, they represent three very distinct ecological stations.

Throughout the region there is practically no rain from the middle of November until the middle of May; the rains begin in June, usually slacken a bit at the beginning of August, and reach their peak in September and October.—G. S., 10 February, 1931.

The larva of the Notodontid moth, *Furcula marshalli*, Hampson.

Prof. Poulton exhibited two examples of the larval *F. marshalli*, kindly sent to him in spirit from Kampala, Uganda, by Mr. G. L. R. Hancock. Although it was evident that they were closely related to the British "Puss Moth" larva, the conspicuous and strongly contrasted colours appeared to be aposematic, indicating a high degree of special protection. Mr. Hancock had also given him excellent drawings of the larvae by a native artist, and these he hoped to show at a later meeting. They showed the brilliancy of colour of the living larva, which had somewhat faded in the specimens preserved in spirit. He also showed the example of the Lycaenid larva, *Liphyra brassolis*, Westw., mounted so as to exhibit both dorsal and ventral surfaces. It had been shown as a spirit specimen at the meeting of 4 February (p. 10).

Mrs. Edith Coleman's further observations on the Fertilisation of Australian Orchids by the male Ichneumonid, *Lissopimpla semipunctata*, Kirb.

[Prof. Poulton said that the following interesting observations had been received in letters from Mrs. Coleman, who had kindly forwarded copies of her papers in

the *Victorian Naturalist* for the library of the Society. Her earlier communications to our publications were to be found in 1928, *Trans.*, **76**: 533; 1930, *Proc.*, **5**: 15, 114.]

1 *January*, 1931, *Walsham, Blackburn, Victoria.*

I am more than ever of the opinion that the males of many of our Ichneumons emerge farther in advance of the females than is generally believed—also that they greatly exceed the females in number.

On 18 December 1930 my daughter and a friend had been to a locality where *Cryptostylis subulata* is plentiful. Returning at 7 p.m., carrying a few flowers, they were astonished to find them surrounded by about 40 *Lissopimpla semipunctata*, even at that late hour. They stated that two and even three insects tried to push under one labellum, and even though at first they attempted to drive them away, it made no difference to the eagerness of the Ichneumons which bore off two and three sets of pollinia as they flew. If I knew where to look, I should be inclined to think that somewhere near were females not yet emerged, and that these great numbers of males were waiting eagerly for their appearance. Since then I have been to the same part, but though the Ichneumons came to our flowers in threes or fours, and pollinated them quite effectively, there was not the same eagerness, nor the same large number of males. In one of my jars a clump of sawfly pupae has been under close observation. So far seven male Ichneumons have emerged, and as yet not one female. (The males emerged six weeks ago.) Two sawflies have emerged, so apparently only two larvae escaped the evil deed of the mother Ichneumon! This suggests a big proportion of males.

13 *January*, 1931.—I will now send you the latest findings concerning *Lissopimpla semipunctata*. On Saturday (10th Jan.) I saw my first living female which was brought into the house, having been taken from a Manuka (*Leptospermum scoparium*) in full flower on which numbers of insects were feeding. We put it in a large glass jar with butter muslin over the top. Then we exposed some flowers of the orchids *Cryptostylis subulata* and *C. leptochila*. Almost at once from 6 to 8 males appeared and visited the Orchids, at times entering a flower two at a time. No notice was taken of the female in the jar. This went on for some twenty minutes or so, more and more males coming, yet none attracted to the female. Then we pinched the males out of the flowers and put about eight of them in the jar with the female. One or two of them attempted to mate with her, and their actions were just as they had been with the flowers. The abdomen swiftly took the falcate curve just as a bull-dog ant doubles itself up when stinging. This, I think, decides beyond doubt the reason of their visits to the flowers. The antennae of the males moved in exactly the same way, presumably caressing the female. But then followed the strangest part. We put in two flowers of the orchid *C. leptochila* and at once the male insects rushed to them, even then attempting to enter two at once. Between whiles they would return swiftly to the female and attempt to mate. When twigs of the tea-tree (Manuka), bearing the honey-scented flowers, were placed in the jar both female and males eagerly fed from them. My present conclusion is that the female had possibly been impregnated and would not allow the males to mate with her. On the following

day we were fortunate enough to see two more females. Both were eagerly foraging in the long grass (possibly Wallaby grass—*Danthonia*—but of this I am not sure) close to the roots, as if searching for caterpillars to parasitise. They moved swiftly and, the grass being so dense and long, they appeared to tumble about like a bird pretending to have a broken wing, and we lost sight of them in the tangle.

To return to the insects in the jar, we noted that the males, when unmolested, remained in the flowers for a considerable time, one for quite five minutes, during which it was almost motionless, with the tip of its abdomen firmly imbedded. Much force is needed to extract the males from the flowers—both claspers and hooked feet helping them to hold on. The next step will be to separate the vegetable from the animal matter so that a photograph can be taken of what I am confident are spermatozoa emitted into the flower. By the help of a fluid that will only stain one of these substances I hope to reach more definite conclusions by the end of the season.

Dr. G. D. H. Carpenter's recent Entomological experiences in Northern Bechuanaland.

Prof. Poulton said that he had received a letter written " on safari " by his friend on 18 December, 1930. The following extract described experiences in marked contrast with those of his journeys in Uganda, Tanganyika Territory, etc., recorded in our *Proceedings* of earlier years :—

" As regards butterflies, they are only just beginning to appear. *D. chrysippus*, however, I have seen daily, as much as up to half a dozen or more, and *all*, without any exception, have been of the *type* form. Other species have been one or two of the universal *P. clelia*, *madagascariensis* and *cebrene*, a *very* few *Teracolus*, and *Zizera*. But more species are appearing now. After we reach Maun we shall travel part of our homeward journey by ox-wagon along the cattle route to Livingstone, and then there will be opportunities for doing some collecting. Curiously *Dorylus* seems absent ! *Megaponera foetens* is universal. I have met for the first time the huge Cicindelid *Manticora*, which I should like to have tested on my pet monkey ! ! A number of birds are of course different from those I have known.

" *Later.*—I have found my old friend *Bromophila caffra* in abundance here, and it is very interesting to see how entirely it conforms to the typical habits of an aposematic species, exposes itself very freely on the ends of twigs and sits about sluggishly. There certainly ought to be a mimic of it !

" One day I was pleased to see a European Bee-eater catch and eat a Dragon-fly, thus confirming my Sese experiences. The other evening my attention was caught by what looked like a large patch of bird-dropping on a stem under the origin of a pair of leaves. As this was a queer position for it I looked again and saw that three ♀ *Lachnocnema bibulus* had disposed themselves thus—two on opposite sides of the upright stem, in the same plane, and the third, with body against those of the other two, but with wings at a slight angle from the plane of the other two. The under surfaces were extremely white—chalky white—and the dark patches only served to accentuate the likeness to a bird-dropping.

" We are now in the longest day of the S. African summer, and it is nice to

think that as the days grow shorter and shorter I get nearer and nearer home! Indeed this will probably not reach you until I have left Ngamiland!

"28 *December*.—Just to show you how very disappointingly scarce are butterflies, I saw the other day, realising with a start that it was the *first*, a *Terias*! I have now seen a single *inaria* ♀ of *misippus*, but all others, all *encedon*, and all *chrysippus* have been the type forms with black and white apex. Even Lycaenids are hardly ever seen. Curson and I have both agreed that Ngamiland is best studied *on the map*! We are bored with the flatness of the country and the bush which, now that we have seen all round the country, has little of novelty for us, and seems to contain such little life. Even bird life has not been exciting, and the reputed herds of game and lions have kept away. We only heard lions one night!"

The structure of the eye in *Aleurodes brassicae*.

Dr. H. Eltringham gave a short account, illustrated by a lantern slide, of the structure of the eye in *Aleurodes brassicae*. While the histological structure was in some respects peculiar, it did not throw any light on the "rosette" formation of pigmented and unpigmented lenses already described by Dr. P. A. Buxton. A full account would be found in a paper to be published in the *Transactions*.

A curious effect of desiccation on the bed-bug (*Cimex lectularius*).

Dr. Wigglesworth said: It is well known that, during starvation, the bed-bug, like many other insects, swallows considerable quantities of air, which serve to maintain the body volume in place of the food and tissues that are consumed. He had recently observed that if the first-stage larvae of the bed-bug were kept for several weeks in a moderately dry atmosphere (for example, 50 per cent. relative humidity at 23° C.), as the circulating fluids became less, the gut, containing bubbles of air, became herniated into the bases of the limbs, and might extend far down the femora.

If such insects were then exposed in a saturated atmosphere, although most of them died in a few days, others recovered, moisture was taken in, and the bubbles of air disappeared from the limbs. On the other hand, if they were retained in the dry atmosphere, the gut wall eventually broke, and the bubbles of air were set free into the body cavity. The larva in this state is often still capable of sucking blood, and if given a moderate meal, both the bubbles in the gut and the free bubbles in the limbs disappear into solution. During this process a certain amount of blood usually escaped into the body cavity, and the red corpuscles could be seen circulating in the blood of the insect. He had had larvae in which such corpuscles had continued to circulate, apparently unchanged, for three weeks—long after the blood in the gut had been completely digested.

Apart from the curious circumstance of desiccation in an insect leading to a femoral hernia which perforates to give rise to a surgical emphysema, these observations presented two points of interest. First, that in the desiccated condition the larvae are apparently hygroscopic and can absorb water vapour from a moist atmosphere (though the possibility of their taking up minute droplets of fluid condensed on the proboscis has not been entirely excluded); and secondly, that small foreign bodies, such as the blood corpuscles of vertebrates, can circulate

in the blood stream, apparently indefinitely, without being removed by phagocytosis or otherwise.

An account of these observations, together with photographs of the condition, has been published in *Nature*, Feb. 28th, 1931.

A preliminary note on *Mantispa*.

Mr. Hugh Main gave some preliminary notes of observations on the metamorphosis of *Mantispa styriaca*, Poda, illustrated by specimens and lantern slides.

He said that in September 1929 during a visit to Agay, a small village between St. Raphael and Cannes, he found attached to the under side of stones lying on the ground some silken homes of a Drassid spider. These contained the lenticular egg cocoons, mostly empty, from which the young spiders had escaped. A few, however, enclosed empty oval cocoons which appeared to be of a Neuropterous type. He considered that these might have been spun by the larvae of *Mantispa*, although it was from the globular egg cocoons of Lycosid spiders that Brauer in 1869 had recorded the breeding of this insect in Austria.* His account of its metamorphoses have been quoted by all subsequent writers on the subject.

A visit to Agay in June 1930 to endeavour to find the cocoons before the emergence of the inmates was successful. A prolonged search secured six spider cocoons containing the desired full Neuropterous cocoons. From these during July active pupae emerged and liberated the *Mantispa* imagines. These were supplied with small flies which were caught on the wing by the raptorial legs of the Mantispids and were rapidly eaten.

One pairing was observed, and at the end of August large numbers of eggs were deposited by two of the females, but only those of one were fertile and hatched. The eggs were on short stalks like those of some Chrysopids. They hatched during September producing small exceedingly active larvae.

According to Brauer, these should hibernate and only get their first meal in the following spring on the eggs or embryos of the spider after discovering and making their way into the egg cocoons.

It was proposed to make further observations on details of the life-history and also to investigate a swelling that is exhibited occasionally by the male between two of the abdominal segments on the dorsal surface. No record of this appearance has been found so far, and it is suggested that this may be a hitherto undescribed glandular apparatus.

Papers.

The following papers were read :—

" A new species of *Forcipomyia* (Diptera, Ceratopogonidae), from the Transvaal," by Mr. B. de Meillon.

" New African Lymantriidae in the British Museum Collection," by Mr. C. L. Collenette.

" Development of wings in Lepidoptera," by Dr. F. A. Dixey, F.R.S.

" The early stages of two species of Sandalidae (Rhipiceridae) from India (Col.)," by Mr. J. C. M. Gardner.

* 1869, Ver. zool.-bot. Ver. Wien, **19** : 831–840.

Wednesday, March 18th, 1931.

Dr. H. Eltringham, F.R.S., President, in the Chair.

Election of Fellows.

The following were elected Fellows of the Society :—B. C. Cox, The Fishery. Mapledurham; K. M. Pennington, Michaelhouse, Balgowan, Natal, South Africa; Capt. J. S. Phillips, M.C., B.A., 66 Redcliffe Square, S.W. 1; Dr. Charles Seydel, Elizabethville, Katanga, Belgian Congo.

The effects of stylopisation on Wasps.

Dr. G. Salt exhibited a collection of stylopised wasps and described, with the aid of photographs, some of the modifications produced in wasps by their Stylopid parasites. A full account of this work has appeared in 1931, *J. Exper. Zool.*, 59 : 133–166.

The law governing the loss of water from an insect.

Dr. P. A. Buxton said that it is a matter of common knowledge that it requires much more water vapour to saturate an enclosed space at a higher temperature than at a lower. From this it follows that if we have two atmospheres at different temperatures, both of which are 50% saturated, it will require a greater amount of water to complete the saturation of the hotter atmosphere than of the colder : the amount of water required to do so is measured by the " saturation deficiency." It will be observed that the two atmospheres under consideration differ in respect of saturation deficiency, though they are at the same relative humidity. In fact these two scales measure quite different things, and if one of them is directly applicable to a particular biological problem, then the other cannot be.

It is known that, other things being equal, the rate of loss of water from an open surface is almost directly proportional to the saturation deficiency, and it has been shown that the same law applies, subject to certain modifications, to mammals and to the leaves of plants. It would be of great interest to know whether the loss of water from an insect is also directly proportional to saturation deficiency. For it is possible that the chitinous covering of the insect, and the fact that much of its loss of water must take place inside the tracheal tree, might result in its diverging widely from the simple physical law.

We have, I believe, no actual measurements of the water lost from the surface of an insect, under controlled atmospheric conditions. But several authors have exposed insects to a range of combinations of temperature and humidity and have recorded either the conditions which are fatal in a definite period, or else the length of exposure which the insect is capable of surviving. From a consideration of the work of these authors, it is apparent that one of the causes of death is loss of water. It is, therefore, possible to take the facts accumulated in these papers, and use them to test the hypothesis that loss of water is determined by saturation deficiency.

It appears that the first authors who examined this problem were Bacot and Martin. They showed that the duration of life of the adult flea *Xenopsylla cheopis* was directly proportional to saturation deficiency, if a number of experiments were carried out at one temperature but under different conditions of humidity. The only exception they noticed was that at very high humidities the proportion broke down; this must be the case, for if the duration of life were determined only by saturation deficiency, then the flea would be immortal in saturated air.

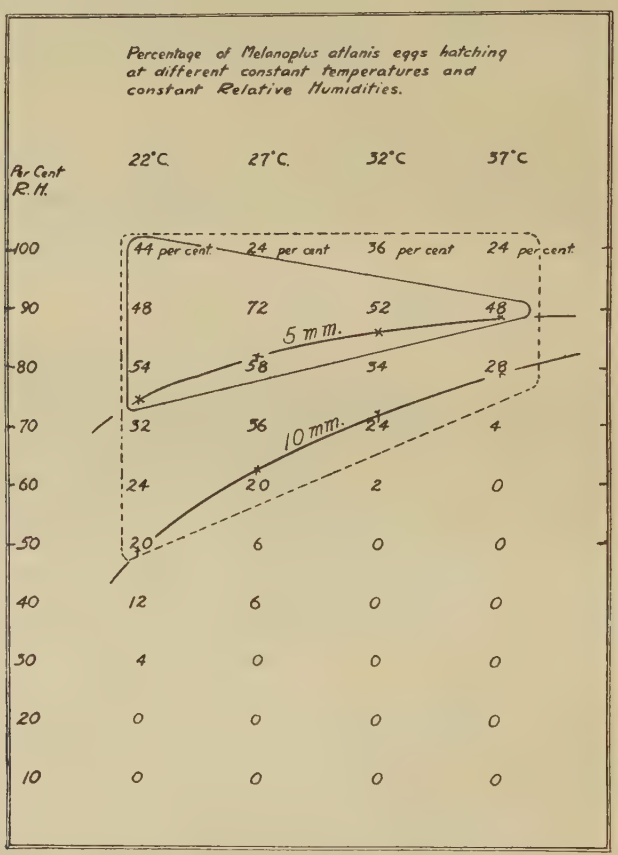


FIG. 1.—Photograph of table by Parker, showing the number of hatches from 100 eggs of *Melanoplus* under certain controlled conditions. Across the photograph have been drawn lines of 5 mm. and 10 mm. saturation deficiency. It is clear that the lower limits of humidity, consistent with hatches of about 50 and about 10%, are delimited by the lines of equal saturation deficiency.

But they found that there is no direct relation between saturation deficiency and duration of life of the flea if experiments at different temperatures were compared: this was doubtless due to the fact that all the vital processes of the flea, and not only the loss of water from it, are affected by differences of temperature. The discovery made by Bacot and Martin is probably much more important than they themselves realised.

The other facts which are quoted here were accumulated by authors who did

not discuss the physical laws which might underlie their observations. The fact that the law can be applied to data which were not collected for this purpose, serves to establish it even more firmly. Parker, for instance, has published a table showing the number of eggs of the grasshopper *Melanoplus* which hatch when they are placed under certain conditions of temperature and relative humidity (Fig. 1). His table shows that 50% is the lower limit of relative humidity which results in about 20% hatches at 22° C., and that it rises steadily to 80% saturation at 37° C. In other words, the air which is just dry enough to kill 80% of the eggs, is half saturated at 22° and four-fifths saturated at 37° C. A second line appears on his table demarcating the lower limit of humidity consistent with half the eggs hatching. This author's table has been photographed, and across it I have drawn lines of 10 mm. and 5 mm. saturation deficiencies. It will be seen that there is a good fit between our lines and the limits which the author himself laid down. In fact, his data show that the proportion of eggs of *Melanoplus* which produce larvae is determined by saturation deficiency at any rate between 22° and 37° C.

Bodenheimer's data for the hatching of eggs of *Schistocerca* can be shown to conform to the same rule, though here the correspondence between the facts and the saturation deficiency is less perfect, perhaps because he was only able to use 20 eggs in each experiment. His experiments extended over a wide range of temperature (12° to 40° C.), and his data do not conform to the saturation deficiency rule, except at the intermediate temperatures: it will be seen that at 12° and 18° C. no eggs hatched. Moreover, high temperature combined with high humidity produces a low percentage of hatching. This is also apparent on Parker's table (Fig. 1): we do not yet know whether it is due to failure of the egg to regulate its temperature by evaporation, or to some other cause.

Kirkpatrick used very large numbers of the cotton-seed bug (*Oxycarenus*) and exposed them to a great range of temperatures and humidities. I have abstracted from his graphs the period in hours necessary to kill 50% of the insects. It can be seen from Fig. 2 that the period is mainly determined by the saturation deficiency. For instance, with saturation deficiencies between 5 and 10 mm. of mercury, the insects live 80 to 167 hours; with saturation deficiencies from 20 to 30 mm., they live 19 to 45 hours; with saturation deficiencies over 30 mm., they live 5 to 18 hours. But within any particular limits of saturation deficiency, life is longer at lower temperatures than higher, doubtless because death is caused in part by the loss of water, in part by the exhaustion of some other substance necessary to life. In the case of *Oxycarenus*, as with the eggs of *Melanoplus* and *Schistocerca*, it will be observed that with high temperatures and low saturation deficiencies, duration of life is unexpectedly short. Taking, for instance, duration of life at 40° C. (see Fig. 2), it rises from 9 to 80 hours as saturation deficiency falls from 50 to 10 mm. But as one approaches saturation, the duration of life falls to 62 and 55 hours. A similar shortening of life in nearly saturated air can be observed if the facts collected at 45° C. are studied.

Jones' data on the duration of life of the unfed larva of the bed-bug (*Cimex*) can be shown to follow the same rule: it is much more accurately measured by saturation deficiency than by relative humidity. The loss of weight of fasting meal-worms (*Tenebrio*) has been shown elsewhere to be partly consistent with the

law of saturation deficiency; but it is clear that, in the case of that insect, a number of other factors have to be considered (Buxton).

It is clear that the law of saturation deficiency applies, within certain temperature limits, both to eggs and to adult insects of several different orders; it is satisfactory to have demonstrated it on the facts published by other workers who were unaware of the use to which their data would be put. I have not yet discovered a large body of facts that cannot be harmonised with this rule, though one

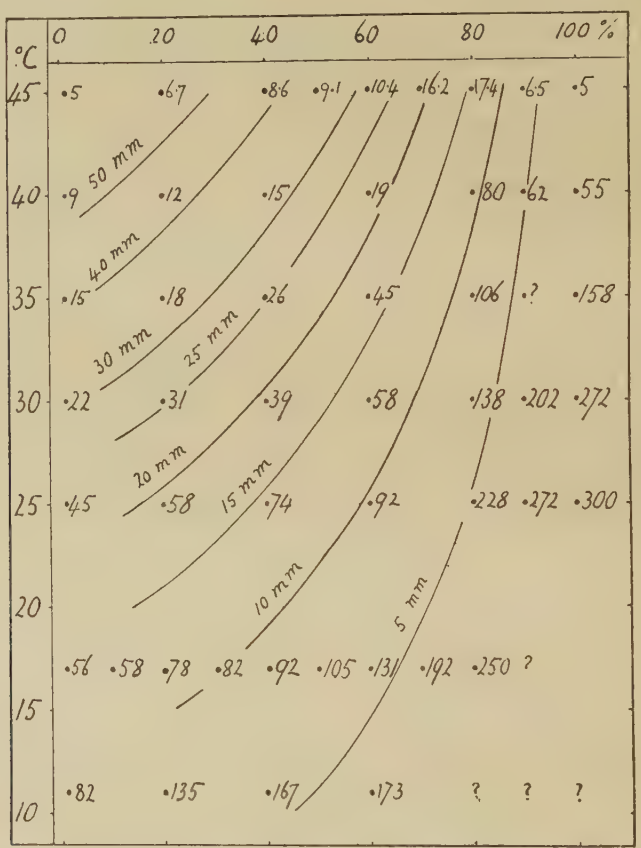


Fig. 2.—Kirkpatrick has given curves showing duration of life of batches of *Oxycarenus* exposed to certain conditions of temperature and humidity. In this graph, the mean durations (hours) are related to saturation deficiency.

may assume that exceptions will be discovered. It will, I think, be clear that entomologists should use the saturation deficiency scale and not that of the relative humidity. This will enable us to cease to speak of the "combined effect of temperature and humidity," for we now have a way of comparing the effect of humidity irrespective of differences of temperature within considerable limits. Assuming that saturation deficiency can be applied to insects in general, and this assumption appears probable, it follows that we can compare two places or two seasons and say that they are identical or not in saturation deficiency, that is to say in

the amount of loss of water which would take place from an insect. The use of this law may lead to great advances in the understanding of the relation between living insects and the environments in which they live.

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Kirkpatrick, T. W. (1923). The Egyptian cotton-seed bug (*Oxycarenus hyalinipennis*), its bionomics, damage, and suggestions for remedial measures. Min. Agric. Egypt Tech. Sci. Service Bull., **35**.

Parker, J. R. (1930). Some effects of temperature and moisture upon *Melanoplus mexicanus mexicanus*, Saussure, and *Camnula pellucida*, Scudder (Orthoptera). Agric. Exper. Stat., Montana, Bull. **223**.

The Epigamic behaviour of *Aglais urticae*, L., etc.

Prof. Poulton said that Sir Richard Threlfall was out of the country when the proofs of the note on p. 99 of 1930 *Proc. Ent. Soc. Lond.*, **5**, were received, so that the following comments had only arrived a few days ago :—

" 11 *March* 1931.—I return the proof, which is perfectly correct. If you wish to put in another sentence you might say that I particularly noticed that the distance between the butterflies was, as near as could be seen, always exactly the same. They re-arranged themselves fully a dozen times during the period of observation."

Cuban and Trinidad Eupelmidae (Chalcididae) observed associating with ants by Dr. J. G. Myers.

Prof. Poulton exhibited three species of the Eupelmid genus *Anastatus* and the ants with which two of them were associated. The Eupelmidae were kindly determined by Dr. C. Ferrière and the ants by Mr. Donisthorpe.

1. *Anastatus* sp. probably *reduvii*, How.—The specimen, with two ants, was labelled " Soledad, Cuba, 29.vii.1929. C. 15." Dr. Myers had also kindly sent the following note :—

" C15, A Eupelmid with a narrow ' waist ' formed by whitening of the base of the abdomen and wings, running about, with a very ant-like gait, among ants (*Pseudomyrma elongata*), on a tree-trunk. The wings are held very closely appressed to the body."

Mr. Donisthorpe had identified the ant as *Pseudomyrma elongata*, var. *cubaensis*, Forel, and pointed out the interesting fact that it is the same species as that

recorded as the model of a Cuban bug and spider by Dr. Myers and Dr. Salt in 1926 *Trans. Ent. Soc. Lond.*, **74** : 427, so that the specimen now sent by Dr. Myers adds a third mimic to the association.

Dr. Ferrière wrote, 23 February, 1931 :—

" The Cuban Eupelmid, which you received from Dr. Myers, is an *Anastatus*, closely related, and I believe, identical with *Anastatus reduvii*, How. This species is very variable in coloration. It is found in U.S.A., Central and South America, as a parasite in the eggs of many Lepidoptera and Hemiptera. The species of *Anastatus* are all parasitic in insect eggs, chiefly those of Lepidoptera, and their presence with ants is rather curious. But I do not think that the whitening of the base of the abdomen is a mimetic character; for it is found in most species of *Anastatus*, which have nothing to do with ants."

2. *Anastatus*, sp. n.—This specimen with three ants (*Macromischa purpurata*, Rog.) was labelled " Mina Carlota, Trinidad Mts., Cuba, 25.iii.1925. 664."

Dr. Ferrière wrote in the same letter concerning this Eupelmid and another :—

" I received from Dr. Myers two other species of *Anastatus*, which were running with ants. One of them, also from Cuba, has short wings and is a real ant-mimic, quite similar to the ants (genus *Macromischa*) with which it was running. It is a new species and I shall be describing it before long."

3. *Anastatus* sp.—This, the second of the " two other species " referred to above by Dr. Ferrière, was, he has informed me, almost certainly undescribed. The following notes appeared on the labels—" Morne Bleu, Trinidad, 25.v.1930. Running about in an ant-like manner among large ants of genus *Ectatomma*, on trunk of tree. Does not resemble *Ectatomma* at all. 1241."

A great Pierine migration in the Argentine : attacks by birds and lizards upon the migrants.

Prof. Poulton said that he had received the following interesting notes from Capt. Kenneth J. Hayward, F.E.S. : —

" 28 *January* 1931. *Establ. Santa Rosa.*
" *Patquia. F.C.C.N.A.* (*La Rioja*), *Argentine.*

" Remembering your interest in receiving records of insects attacked by animals, I made a few notes on this subject during a great and prolonged migration of *Pieris phileta automate*, Burm., that commenced on December 4th, and was about to cease when I left this address to collect in the Nevado de Famatina on the last day of the year 1930. As a matter of fact I encountered traces of this flight up to above 10,000 ft., and personally witnessed it on Jan. 2nd and 3rd at 7000 ft. near Chilecito. My notes on this migration will appear, I believe, in one of the forthcoming issues of the *Revista* of the Arg. Ent. Soc.

" The flight commenced on Dec. 4th, with males only, all fresh, but at least 95% badly chipped, the chipping being in a great number of cases uniform on opposite wings. In some cases the apices of the wings had been torn off. Dec. 5th was overcast and no insects in movement. On the 6th I examined more than 2000 specimens and found 1% (approx.) in perfect condition, the remainder fresh but with chipped (not worn or rubbed), wings : 5% were now females. On the

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MEETINGS

TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W. 7

1931.

Wednesday,	October	7
,,	,, ...	21
,,	November...	4
,,	,, ...	18
,,	December...	2

1932

,,	January (Annual Meeting)	20

The Chair will be taken at Eight o'clock.

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